“A COMPARATIVE STUDY TO ANALYZE THE EFFICACY OF TWO DISTINCTLY DIFFERENT MODES OF EXERCISE IN IMPROVING FUNCTIONAL CAPACITY AND QUALITY OF LIFE IN SUBJECTS WITH CORONARY ARTERY BYPASS GRAFT”

A DISSERTATION SUBMITTED TO THE TAMILNADU Dr. M.G.R MEDICALUNIVERSITY, CHENNAI, AS PARTIAL FULFILLMENT OF THE MASTER OF PHYSIOTHERAPY DEGREE

APRIL 2012.

CERTIFICATE

Certified that this is the bonafide work of **Miss. JANETHA. A** of K.G. College of Physiotherapy, Coimbatore, Submitted in partial fulfillment of the requirements for the Master of Physiotherapy Degree course from the Tamil Nadu Dr.M.G.R. Medical University under the **Registration No: 27102213** for the April 2012 Examination.

Date: Principal

Place : Coimbatore

Date :

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_____ _____

Internal Examiner **External Examiner**

ACKNOWLEDGEMENT

It is my privilege to thank God, the Almighty for showering his blessings and who has always been my source of strength and inspiration and has guided me in all endeavours leading to the completion of this project

With great awe, I would like to express my sincere thanks to **Padmashri. Dr. G. Bakthavathsalam,** Chairman, K.G. Hospital for providing a wonderful environment and the necessary infrastructure to cultivate knowledge.

With sincere gratitude, I would like to thank **Mrs. Vaijayanthi Mohandas,** Director of education, K.G. College of health science for her enthusiasm and concern for the well being of the students.

My sincere thanks to **Prof. S. Ramesh MPT.,** Principal, K.G. College of Physiotherapy for his constant and unwavering encouragement devotion and support.

I express my heartful gratitude to **Prof. Mr. B. Arun, M.P.T., CMPT.,** Vice principal, K. G. College of physiotherapy for instilling the professional attitude of discipline and for his support.

My special thanks to my thesis guide, **Prof. Mrs. M. Arul Priya, M.P.T,** Professor, K.G College of physiotherapy, Coimbatore, for her guidance, timely help and extensive support in this thesis.

I am of course indebted to all the **Faculty Members** of **K.G. College of Physiotherapy** and **Physiotherapists** in the **Department of Physiotherapy**, **K.G. Hospital** and for their priceless contribution in cultivating education and special skills in me which stands significant for my career.

I whole hearted thank **Mr. Kathirvadivelu,** Librarian for providing me with needed reference materials.

I am obliged to offer my sincere thanks to all **My Subjects** for having consented to participate in this study forgoing all suffering.

My deep humble sense of gratefulness to **My Dad & Mom** for their everlasting and external love they have given me.

Last but not least, I submit my thanks to **My Friends** for their unwavering supports, encouragement and love which helped me in doing my project and my studies as well.

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INTRODUCTION

Coronary artery disease is one of the most frequent illness affecting general population all over the world. It is the leading cause of mortality. The Coronary artery disease accounts for approximately 50% of cardiovascular disease deaths. The incidence of coronary artery disease is three times greater in men when compared to women. The ratios of 1:20 persons suffer from Coronary artery disease according to American Heart Association.

It commonly occurs in the age group between 35 – 65 years. In India, males are more prone to Coronary artery disease due to smoking and life style behaviours. The male to female ratio is 4:1 persons. The Coronary artery disease is likely to cause increased death rate by 2.4 million in 2020 (World Health Organisation).

The high resting heart rate and systolic blood pressure indirectly implies on cardiovascular disease and increases the mortality rate. The narrowing lumen of the coronary artery is due to the formation of atherosclerosis plaque. It progresses and leads to complete occlusion. The pathological process leads to imbalance between myocardial oxygen supply and demand. The Coronary artery disease present with angina, heart failure or sudden death (Desmond G Julian., 1991).

The risk factors of coronary artery disease are lipid disorder [LDL↑, HDL↓], hypertension, obesity, smoking, reduced physical activity, diabetes, alcohol consumption. Modification of life style behaviour such as cessation of

smoking, proper dietary intake, physical activity can significantly reduces the risk of Coronary artery disease (Marote et al., 2005).

The Coronary artery disease is treated by drug therapy and in some cases revascularization is necessary. The two methods of revascularization are Percutaneous transluminal coronary angioplasty and Coronary artery bypass graft. Coronary artery bypass graft is the commonest surgery for multiple blocks in coronary artery. (Robert H Jones et al., 1996).

The narrowed segment of the artery is bypassed by a graft taken from saphenous vein or internal mammary artery. The patency of the Coronary artery bypass graft is done by anti platelet therapy and lipid lowering drugs. Post operative cardio respiratory impairment may occur. Coronary artery bypass graft surgery prolongs the life and quality of life in Coronary artery disease patients. (Alderman E L et al., 2002).

Cardiac rehabilitation is a valuable non pharmacological intervention to improve cardio respiratory fitness and overall health status in patients with Coronary artery disease. The programmed Cardiac rehabilitation for post Coronary artery bypass graft patients helps to restore their optimal physiological, psychological, vocational and educational status. Cardiac rehabilitation has an important part in reducing mortality rate by 26% compared to standard medical care. The goals of these programs are to prevent the deleterious effects of prolonged bed rest after surgery, to enhance cardiac

function, risk factor modifications, improve physical activities and self confidence in these patients. (Montero et al., 2005)

Cardiac rehabilitation is given as an individualized programme, considering all the principles of training (mode, frequency, intensity & duration). Among these principles exercise intensity is the most important part of cardiac rehabilitation (Mc ardle katch & katch, 2006). Exercise intensity is determined by percentage of Heart rate maximum (55-90%) for subjects in Cardiac rehabilitation (American College of Sports Medicine 2000, 2006). Exercise training is effective in the improvement of functional capacity, reduction in risk factors and mortality rate in post Coronary artery bypass graft patients (Maines T Y et al., 1997).

The post Coronary artery bypass graft surgery is more effective with individualized cardiac rehabilitation programme which improves the speed of recovery and quality of life. The prognosis of the Coronary artery bypass graft surgery is improved after aerobic exercise training. After aerobic exercise training ,functional capacity in these patients is also found increased to the maximum (American Heart Association 2007).

Aerobic exercise is the major component of the exercise regimen of the Coronary artery disease patients (British Association for Cardiac Rehabilitation 2003). The hemodynamic effect of aerobic exercise includes reduction in resting heart rate, heart rate, systolic blood pressure at sub maximal intensity

(Froclicher & Myers 2006). Aerobic training is relatively safe for vast majority of cardiovascular patients (American College of Sports Medicine 2006).

Continuous moderate training is given at intensity of 60-70% of Heart rate, continuous throughout the training session. Continuous moderate training has been effective in reducing the cause and mortality rates. Continuous moderate training involves uninterrupted activity performed at the constant sub maximal intensity (British Association for Cardiac Rehabilitation 2003).

Aerobic interval training is given at the intensity of 80-90% of Heart rate with rest periods during training .Many studies suggest aerobic interval training has shown improvement in cardiovascular functions. Aerobic interval training is more effective in improvement of exercise capacity and quality of life in post Coronary artery bypass graft surgery patients. There is also improvement in physical work capacity following Aerobic interval training. (Gunneng et al., 2002).

1.1 NEED FOR THE STUDY:

The Coronary artery bypass graft subjects who were included in the Cardiac rehabilitation program has significantly low incidence of major adverse cardiac events. Exercise training is the most important key element in cardiac rehabilitation in post operative Coronary artery bypass graft subjects. Aerobic exercise training improves the functional capacity, risk factor modification and overall quality of life in Coronary artery bypass graft subjects (Wenger N K et al., 1995).

Aerobic exercise is considered as a treatment and also as a prevention of Coronary artery disease. Many studies concluded that aerobic interval training is more effective in risk factor modification and quality of life. Continuous moderate training has also been effective in reducing the risk factors and improving functional capacity. So this study is aimed to compare the maximal effect of Continuous moderate training and Aerobic interval training in improving functional capacity and quality of life post Coronary artery bypass graft subjects.

1.2 PURPOSE OF THE STUDY:

The purpose of study is to compare the effect of two different modes of aerobic training in subjects with Coronary artery bypass graft.

1.3 KEYWORDS:

Coronary artery bypass graft, Aerobic interval training, Continuous moderate training.

1.4 OBJECTIVES FO THE STUDY:

- To find the effectiveness of Continuous moderate training in Coronary artery bypass graft subjects.
- To find the effectiveness of Aerobic interval training in Coronary artery bypass graft subjects.
- To compare the effectiveness of Continuous moderate training and Aerobic interval training in Coronary artery bypass graft subjects.

1.5 HYPOTHESIS:

NULL HYPOTHESIS:

There is no significant difference between Continuous moderate training and Aerobic interval training in improving functional capacity and Quality of life in subjects with Coronary artery bypass graft.

ALTERNATE HYPOTHESIS:

There is significant difference between Continuous moderate training and Aerobic interval training in improving functional capacity and Quality of life in subjects with Coronary artery bypass graft.

REVIEW OF LITERATURE

Robert H Jones et al., (1996)

They conducted a study to evaluate the long term survival in CABG and PTCA in coronary artery disease patients. 9268 patients were included in this study, 2449 were treated with medicine and 2929 with angioplasty, 3890 with CABG. The outcome measure was severity of coronary artery stenosis. It was concluded that maximal survival benefit occurs in triple vessel disease patients from CABG surgery.

D Wosornu et al., (1996)

They conducted a study to evaluate the effects of aerobic interval training and strength training in post CABG surgery patients. 81 subjects were randomly allotted into three groups (Aerobic, Strength and Control group). The subjects were trained for a period of 6 months and exercise capacity was measured. It was concluded that aerobic exercise training caused earlier sustained improvement in exercise capacity of the patients.

Takashi. Hirotani et al., (1999)

They conducted a study to assess the use of internal mammary artery for Coronary artery bypass graft and survival rate in diabetic patients after surgery. A total of 420 patients were included in the study. Among 420 patients, 164 patients were non diabetic and 155 patients were diabetic. Based on the results it was concluded that internal mammary artery had greater survival rate in diabetic patients.

A Stahle et al., (1999)

They conducted a study to investigate the effects of aerobic training program in subjects with coronary events. 101 patients were divided into 2 groups one group was an exercise group and one group was a control group. The subjects were trained for 12 months. The self reported quality of life questionnaire was recorded in 3 and 12 months duration. It was concluded that aerobic training improves quality of life in these patients.

Kathron M et al., (1999)

They conducted a study to find out the relationship between physical activity and coronary artery disease among high risk women. 39372 subjects were included in this study and they were followed from 1992 to 1999. Coronary artery disease is correlated with energy expenditure for all activities. It was concluded that even light to moderate activities were associated with lowering the risks of coronary artery disease in women.

Jeroen J Bax et al., (1999)

They conducted a study to analyze the long term effects of revascularization. 68 patients were assessed by echocardiography before and after revascularization. They concluded that there was improvement in left ventricular ejection fraction and New York Heart Association functional class after revascularization.

Hans Tygesen et al., (2001)

They conducted a study to find the effect of intensive exercise in cardiac rehabilitation in coronary artery bypass graft and myocardial infarction patients. A total of 62 patients were included in the study and underwent 3months of exercise training .They concluded that cardiac rehabilitation improves exercise capacity.

Viswanathan mohan et al., (2001)

They conducted a study to evaluate the prevalence and risk factors of coronary artery disease in urban south Indian population. The study was conducted at two areas in Chennai. 1399 subjects participated in this study. All subjects underwent three laboratory investigations of cholesterol profile, glucose tolerance and ECG. Diagnosis of coronary artery disease was based on these tests and previous medical history. It was concluded that there was a high prevalence of coronary artery disease in urban south Indian population.

Yoshihiro Akashi et al., (2003)

They conducted a study to evaluate the effects of moderate intensity aerobic training on exercise capacity and vasodilator capacity in post cardiac event patients. 21 patients underwent two weeks of training. Blood pressure, respiratory gas analysis, cardiac outflow were measured during the exercise test. Results showed that moderate intensity aerobic training improved exercise tolerance and vasodilator capacity in post cardiac event patients.

Eva Hetlandb et al., (2004)

They conducted a study to investigate the effects of high intensity aerobic interval training compared with continuous moderate training in subjects with coronary artery disease. 21 patients were randomly allotted into two groups and trained for 10 weeks. The VO2 max was measured before and after the training sessions. It was concluded that aerobic interval training was superior to continuous moderate training in improving the VO2 max.

Jerilyn K.Allen et al., (2004)

They conducted a study to evaluate the functional status of patients after CABG and PTCA for one year during recovery. The study consisted of 2 groups, 106 patients in CABG group and 64 patients in PTCA group. Functional status was evaluated by activities of daily living, work performance, social activity, mental health and quality of social interaction at 1, 6 and 12 months interval. The results showed that the work performance and psychological functioning improved significantly in the CABG group.

D. Wosornu et al., (2005)

They conducted a study to determine the effects of continuous moderate aerobic and power training in post CABG subjects. 55 subjects were divided into two groups and trained for 6 months. The exercise performance on treadmill, haematology and haemostatic factors were recorded. It was concluded that aerobic exercise training group had improvement in exercise performance earlier than power training group.

Shyi Kuen WA et al., (2005)

They conducted a study to evaluate the effect of cardiac rehabilitation in post CABG patients. A total of 22 patients were included in the study. The study consisted of 2 groups, a cardiac rehabilitation group and a control group.11 patients were allotted in each groups. The resting heart rate was measured. Cardiac rehabilitation group received 36 exercise sessions for three times a week. Results showed that cardiac rehabilitation group had significantly lower resting heart rate than the control group.

Farzaneh Taghian et al., (2006)

They conducted a study to analyze the effects of cardiac rehabilitation in post Cardiac surgery patients. 32 patients were included in the study and underwent two months of exercise training. The functional capacity was assessed by Six minute walk test. They concluded that there was improvement in functional capacity and also six minute walk test was easy and safe for post cardiac surgery patients.

Yi Wen lin et al., (2006)

They conducted a study to evaluate the effects of cardiac rehabilitation and home based exercise training on heart rate recovery in post CABG patients. In a total of 54 patients, 18 in the cardiac rehabilitation and 18 in the home based exercise group and 18 in the control group. The patients received 12 weeks of training. It was concluded that cardiac rehabilitation program had a positive effect on heart rate recovery in post CABG patients.

G Kervio et al., (2007)

They conducted a study to evaluate the effects of aerobic interval training and continuous aerobic training in post CABG patients. 23 patients were divided into two groups and were trained for 3 months. Peak oxygen uptake, peak work load, heart rate, quality of life questionnaire was measured before and after 3 months of training. They found that, post CABG patients peak heart rate was increased after the interval training.

Claudia Fiorina et al., (2007)

They conducted a study to evaluate the feasibility of six minute walk test as a measure of cardiac rehabilitation programme in post surgical patients. In this study 348 patients were included in this study and six minute walk test was performed before and after the training. Results showed that there was no relationship between the gender, age, comorbidities and they were independently associated with six minute walk test. The distance was significantly increased in these patients. The six minute walk test was feasible and well tolerated by adult and older patients shortly after the cardiac surgery.

Terence Kavanagh et al., (2008)

They conducted a study on walking distance versus peak oxygen uptake to predict the prognosis of post CABG and MI patients. The 12 months walking based training was given and followed. Peak oxygen uptake and walking distance were measured. On the basis of study findings it was concluded that subjects who underwent exercise rehabilitation program showed improvement

in walking distance. It was a strong independent predictor of peak oxygen uptake.

J C Busch et al., (2008)

They conducted a study to investigate the effects of standard exercise training versus functional training in post CABG patients. A total of 121 patients were included in the study. Among the 121 patients, 57 were in the functional training group, 64 in the standard exercise training group. The training was given for 6 weeks period of time. The six minute walk distance and quality of life questionnaire was recorded before and after the training program. The six minute walk distance and quality of life was improved in both the groups.

Trine T. Moholdt et al., (2009)

They conducted a study to evaluate the effects of aerobic interval training versus continuous moderate intensity training in improving the exercise capacity and quality of life in post CABG patients. 59 subjects were randomised into two groups and trained for a period of 7 months. The exercise capacity was measured before and after the training. Result showed that the aerobic interval training was significantly effective in improving the exercise capacity.

Stefan Hofer et al., (2009)

They conducted a study to evaluate the effects of cardiac rehabilitation in improving the quality of life in patients with post coronary artery bypass surgery. 487 patients were included in the cardiac rehabilitation and trained for 1 month duration. It was concluded that there was an improvement in the health related quality of life in post CABG patients who underwent cardiac rehabilitation program.

K Meyer et al., (2009)

They conducted a study to investigate the effects of interval and continuous aerobic training in patients with post CABG surgery. 90 subjects were assigned to each group and trained for a period of 3.5 weeks. Heart rate, blood pressure, rate pressure product, glucose, lactate and physical performance were recorded. Results showed that the interval training group had an improvement in physical performance and reduction in heart rate, rate pressure product (rest) and lactate level. The aerobic interval training improved the physical performance more effective than continuous aerobic training in post CABG patients.

Horlitz et al., (2010)

They conducted a study to assess the exercise intensity and energy expenditure of interval compared with continuous exercise. The aerobic capacity was measured in 14 subjects. They concluded that higher energy

expenditure occurs in interval exercise and maximum cardiovascular benefits occurs in the interval exercise training.

Ramin Shabani et al., (2010)

They conducted a study to investigate the effect of cardiac rehabilitation program in improving the exercise capacity in post CABG women. A total of 60 female subjects were included in the study. 30 women both in experimental and in control group were assigned randomly. The functional capacity of the subject was evaluated with six minute walk test and exercise test during pre and post training session. The 12 weeks of exercise training showed improvement in exercise capacity and six minute walk distance. It was concluded that women undergoing cardiac rehabilitation had improvements in exercise duration time, six minute walk distance, rate pressure product and supply of oxygen to the cardiac muscles.

Viviane Conraad et al., (2010)

They conducted a study to assess the effects of aerobic interval training and continuous moderate endurance training in post CABG patients. 200 subjects were randomly divided into two groups and were trained for 12 months and maximal aerobic capacity was measured. It was concluded that aerobic interval training is effective in improving exercise capacity in post CABG patients.

METHODOLOGY

3.1 STUDY DESIGN

An Experimental study with 2 groups, Pre test- Post test design

3.2 STUDY SETTING

Department of Cardiology, K.G Hospital and postgraduate medical institute, Coimbatore.

3.3 STUDY POPULATION

Post coronary artery bypass graft subjects were selected for the study after consideration of inclusion and exclusion criteria.

3.4 STUDY DURATION

Total study duration of six months. Rehabilitation frequency was 4 times a week for 12 weeks.

3.5 SAMPLING METHOD

All post CABG subjects who were referred to the department of physiotherapy, KG Hospital for Phase II cardiac rehabilitation were selected. 30 subjects were selected and assigned into two Groups with 15 subjects in each Group by using random sampling method.

3.6 CRITERIA FOR SELECTION

INCLUSION CRITERIA:

- Age group between 45-55 years.
- Both sexes were included.
- Subjects who underwent triple vessel CABG.
- Subjects who underwent CABG with warm blood cardioplegia.
- Subjects who underwent Phase I cardiac rehabilitation.

EXCLUSION CRITERIA:

- Subjects with acute episodes of myocardial infarction.
- Subjects who underwent CABG with other methods of cardioplegia.
- Subjects with orthopaedic and neurological problems.
- Unwilling to co-operate.

3.7 VARIABLES

- Independent variables
    - Continuous moderate training
    - Aerobic interval training
- Dependent variables
    - Functional capacity
    - Quality of life

3.8 ORIENTATION OF SUBJECTS

Before treatment, all subjects were explained about the study and procedure to be applied and were asked to inform if they feel any discomfort during the course of the treatment.

3.9 OPERATION TOOLS

- Stop watch
- Measuring tape
- Borg scale
- Motor driven treadmill
- Quality of life questionnaire

3.10 PARAMETERS FOR MEASUREMENT

- Functional capacity (Six minute walk test)
- Quality of life (Quality of life questionnaire)

3.11 PROCEDURE

All Subjects with post CABG surgery who satisfied the inclusion and exclusion criteria were selected for this study. A clear explanation of the study was given to the subjects and written consent form was obtained.

A total of 30 subjects were included in this study and randomly assigned into two equal groups, 15 subjects in each group.

Group A- Subjects were given continuous moderate training.

Group B- Subjects were given aerobic interval training.

The pre-test values were taken to measure functional capacity using six minute walk test and quality of life using the questionnaire. All subjects had one orientation session about treadmill walking before the exercise test. The symptom limited graded exercise test was performed using a treadmill. The exercise training consists of a warm up phase, an exercise phase and a cool down phase. After a brief warm up on the treadmill, subjects were instructed to walk as long as possible till the level which reproduced the symptoms. The heart rate was recorded using heart rate monitor.

GROUP A

CONTINUOUS MODERATE TRAINING

Warm up phase:

Subjects were given a warm up period for 10 minutes (50% of HR max).

Exercise phase:

The intensity of the exercise was increased to the target intensity of the subjects for 30 minutes (70% of HR max).

Cool down phase:

Subjects were given a cool down period for 10 minutes (50% of HR max).

GROUP B

AEROBIC INTERVAL TRAINING

Warm up phase:

Subjects were given a warm up period for 10 minutes (50% of HR max)

Exercise phase:

The intensity of the exercise was increased to the target intensity of the subjects for 5 minutes (90% of HR max) with the rest interval of 5 minutes (70% of HR max) for 60minutes.

Cool down phase:

Subjects were given a cool down period for 10 minutes (50% of HR max).

The exercise program was carried out for the duration of 3 months at a frequency of 4 times a week for 12 weeks and the post test values were taken after exercise training. The pre test and post test data were analyzed statistically. All safety equipments and drug needed for stabilization of cardio respiratory parameter in case of emergency was made readily available.

3.12 STATISTICAL TOOL:

Dependent 't' test

The following statistical tool was used to compare the pre and post test values within the group.

Formula: Dependent t-test

$$S = \sqrt{\frac{\sum d^2 - \frac{(\sum d)^2}{n}}{n-1}}$$

$$t = \frac{\bar{d}\sqrt{n}}{s}$$

Where,

d = difference between the pre test versus post test

$\bar{d}$ = mean difference

n = total number of subjects

S = standard deviation

Independent 't' – test

The independent 't' test was used to compare the pre and post test values between the groups.

Formula: Independent t-test

$$S = \sqrt{\frac{\sum\left(X_1 - \overline{X_2}\right)^2 + \sum\left(X_2 - \overline{X_2}\right)^2}{n_1 + n_2 - 2}}$$

$$t = \frac{\overline{X_1} - \overline{X_2}}{S}\sqrt{\frac{n_1 n_2}{n_1 + n_2}}$$

Where,

$\overline{x_1}$ = Mean of Group A

$\overline{x_2}$ = Mean of Group B

$\sum$ = sum of the value

n_1 = number of subjects in Group A

n_1 = number of subjects in Group B

S = standard deviation

Level of significance: 5%

Percentage of difference formula:

Percentage difference =

$$\frac{\text{Post test mean} - \text{Pre test mean}}{\text{Pre test mean}} \times 100$$

DATA ANALYSIS AND INTERPRETATION

4.1.A. TABLE-I

COMPARISON BETWEEN THE PRE TEST VALUES OF GROUP A AND GROUP B

SIX MINUTE WALK DISTANCE

S.NO	GROUPS	MEAN	STANDARD DEVIATION	't' VALUE
1.	GROUP A	543.4	± 3.180	1.4026
2.	GROUP B	541.73	± 3.327	

Table shows statistical analysis of pretest values of six minute walk distance of Group A and Group B.

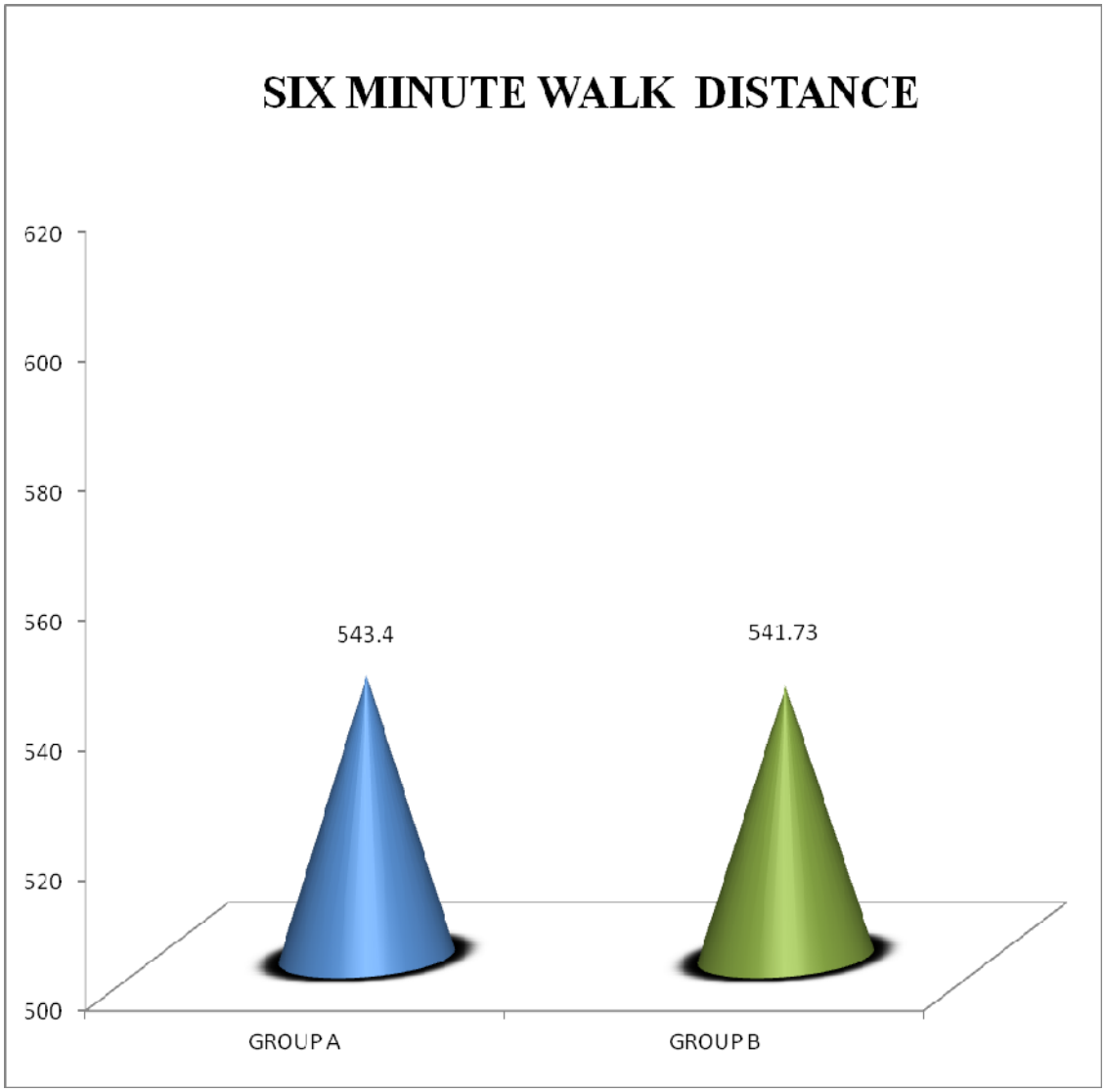
4.1.B. ANALYSIS OF RESULT

Using independent ‘t’ test

Comparing pre test Six minute walk distance of Group A and Group B: calculated ‘t’ value (1.4026) is less than table value (1.701) at 5% level of significance for ‘t’ test showing that there is no significant difference between two groups.

4.1.C. GRAPH-I

GRAPHICAL REPRESENTATION OF PRE TEST VALUES OF GROUP A AND GROUP B



Graph shows the pretest means of six minute walk distance of Group A and Group B.

4.2.A. TABLE-II

PRE TEST AND POST TEST VALUES OF GROUP A

SIX MINUTE WALK DISTANCE

S.NO	GROUP A	MEAN	STANDARD DEVIATION	't' VALUE	PERCENTILE INCREASE
1.	PRE TEST	543.4	± 3.180	13.38	4.36%
2.	POST TEST	567.1	± 6.856		

Table shows statistical analysis of pre and post test values of six minute walk distance of Group A.

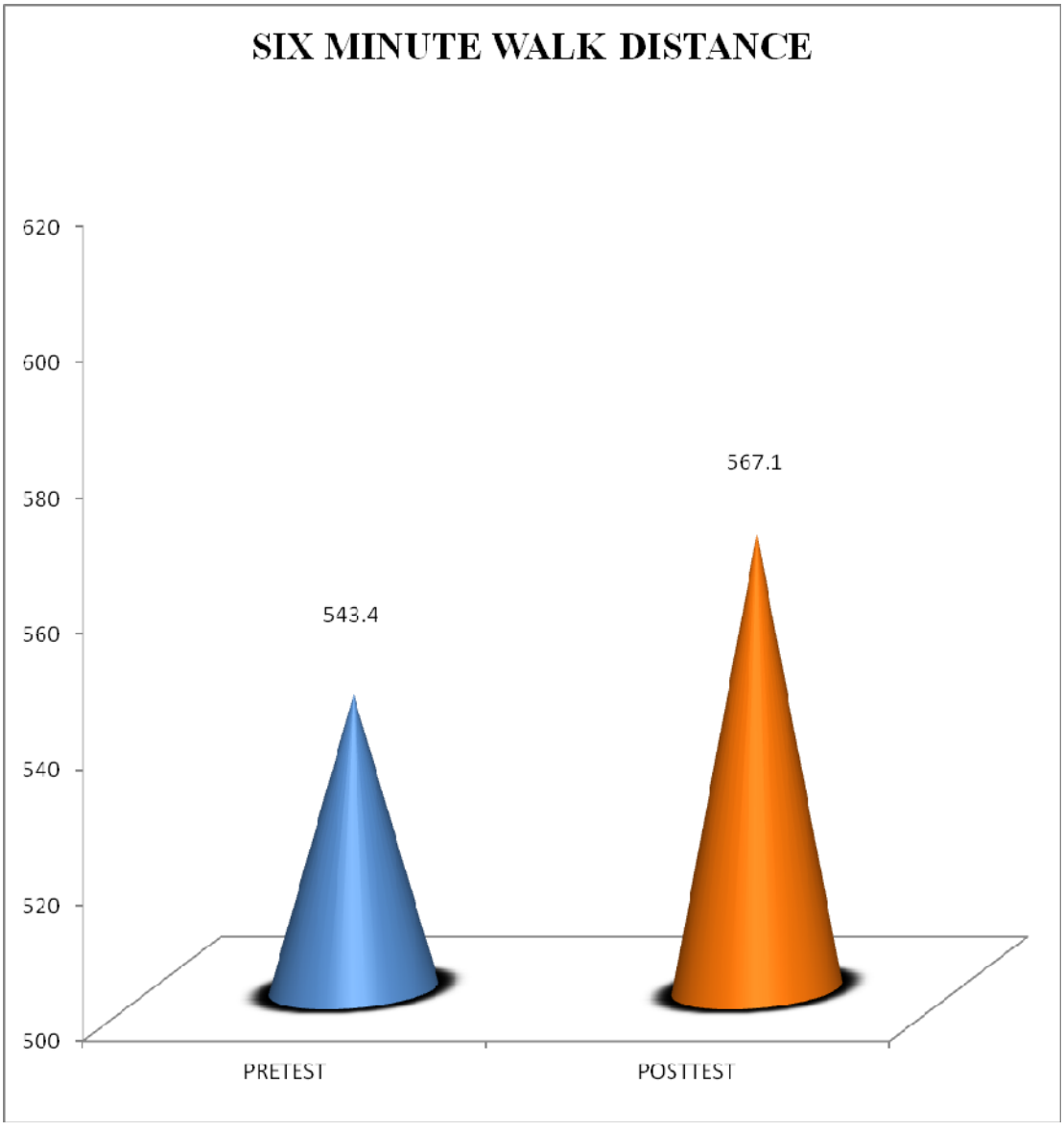
4.2.B. ANALYSIS OF RESULT

Using dependent ‘t’ test

Comparing pre and post test six minute walk distance of Group A. Calculated ‘t’ value (13.38) is greater than table value (1.761) at 5% level of significance for ‘t’ test showing that there is a significant difference between two values.

4.2.C. GRAPH-II

GRAPHICAL REPRESENTATION OF PRE TEST AND POST TEST VALUES OF GROUP A



Graph shows the pre test and post test means of six minute walk distance of Group A.

4.3.A. TABLE-III

PRE TEST AND POST TEST VALUES OF GROUP B

SIX MINUTE WALK DISTANCE

S.NO	GROUP B	MEAN	STANDARD DEVIATION	't' VALUE	PERCENTILE INCREASES
1.	PRE TEST	541.73	± 3.327	18.3478	10.38%
2.	POST TEST	598.0	± 11.520		

Table shows statistical analysis of pre and post test values of six minute walk distance of Group B.

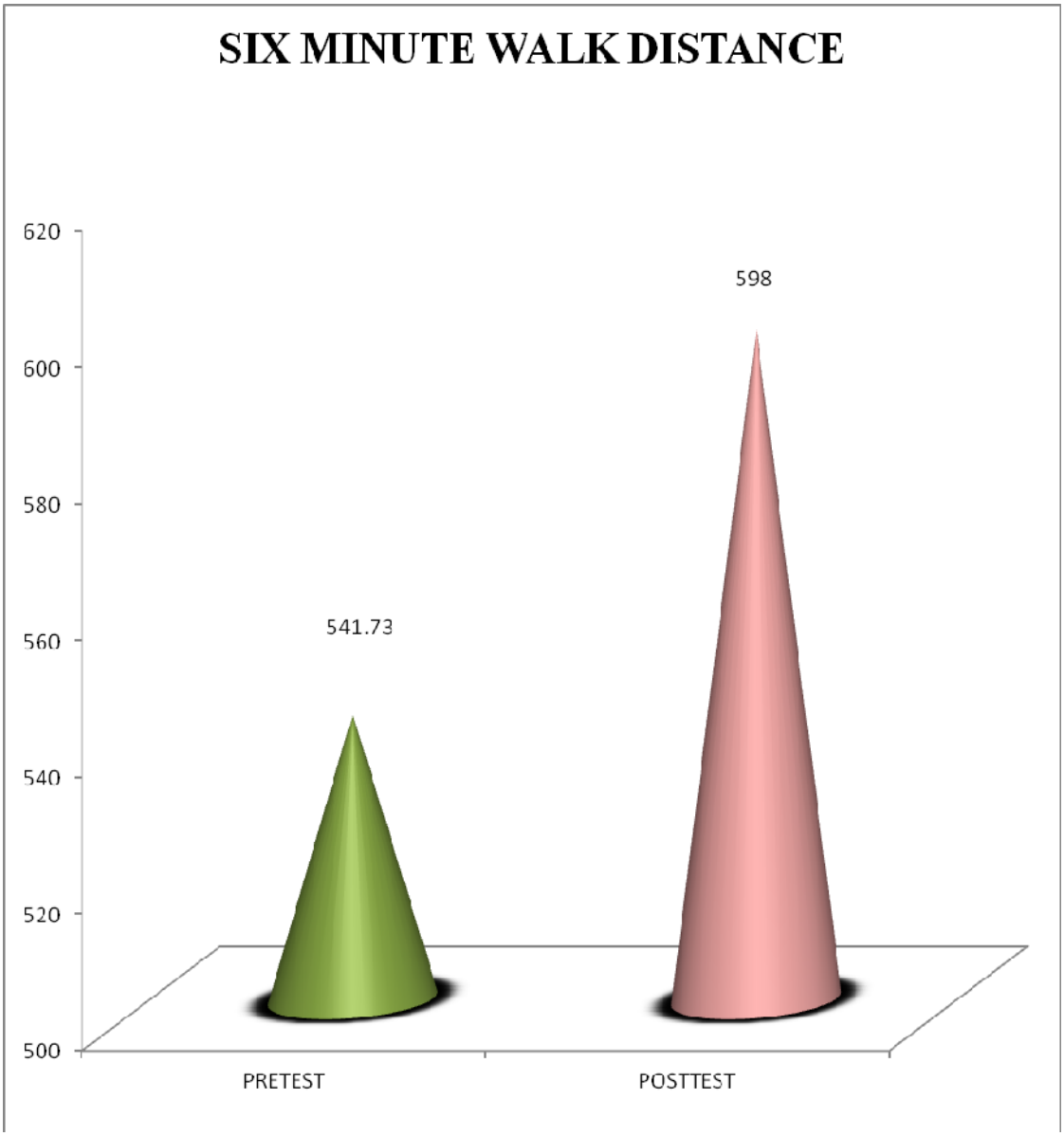
4.3.B. ANALYSIS OF RESULT

Using dependent ‘t’ test

Comparing pre and post test six minute walk distance of Group B. Calculated ‘t’ value (18.3478) is greater than table value (1.761) at 5% level of significance for ‘t’ test showing that there is a significant difference between two values.

4.3.C. GRAPH-III

GRAPHICAL REPRESENTATION OF PRE TEST AND POST TEST VALUES OF GROUP B



Graph shows the pre test and post test means of six minute walk distance of Group B.

4.4.A. TABLE-IV

COMPARISON BETWEEN THE POST TEST VALUES OF GROUP A AND GROUP B

SIX MINUTE WALK DISTANCE

S.NO	GROUPS	MEAN	STANDARD DEVIATION	't' VALUE
1.	GROUP A	567.10	± 6.856	8.9270
2.	GROUP B	598.0	± 11.520	

Table shows statistical analysis of Post test values of six minute walk distance of Group A and Group B.

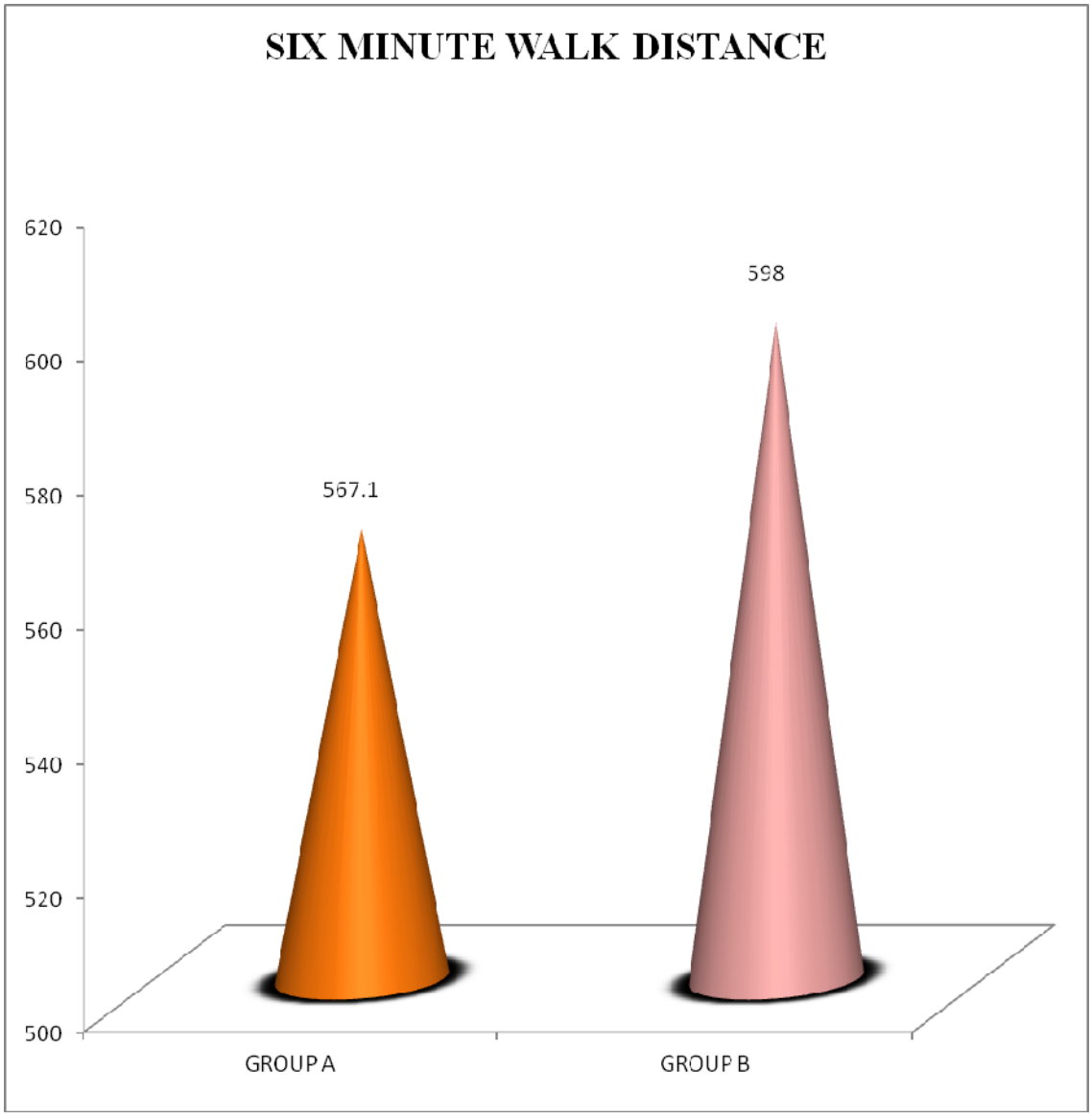
4.4.B. ANALYSIS OF RESULT

Using independent ‘t’ test

Comparing post test six minute walk distance of Group A and Group B. calculated ‘t’ value (8.9270) is greater than table value (1.701) at 5% level of significance for ‘t’ test showing that there is a significant difference between two groups.

4.4.C. GRAPH-IV

GRAPHICAL REPRESENTATION OF POST TEST VALUES OF GROUP A AND GROUP B



Graph shows the post test means of six minute walk distance of Group A and Group B.

4.5.A TABLE-V

COMPARISON BETWEEN THE PRE TEST VALUES OF GROUP A AND GROUP B

QUALITY OF LIFE QUESTIONNAIRE

S.NO	GROUPS	MEAN	STANDARD DEVIATION	't' VALUE
1.	GROUP A	36.93	± 2.40	1.6396
2.	GROUP B	38.20	± 1.78	

Table shows statistical analysis of Pre test values of Quality of life questionnaire of Group A and Group B.

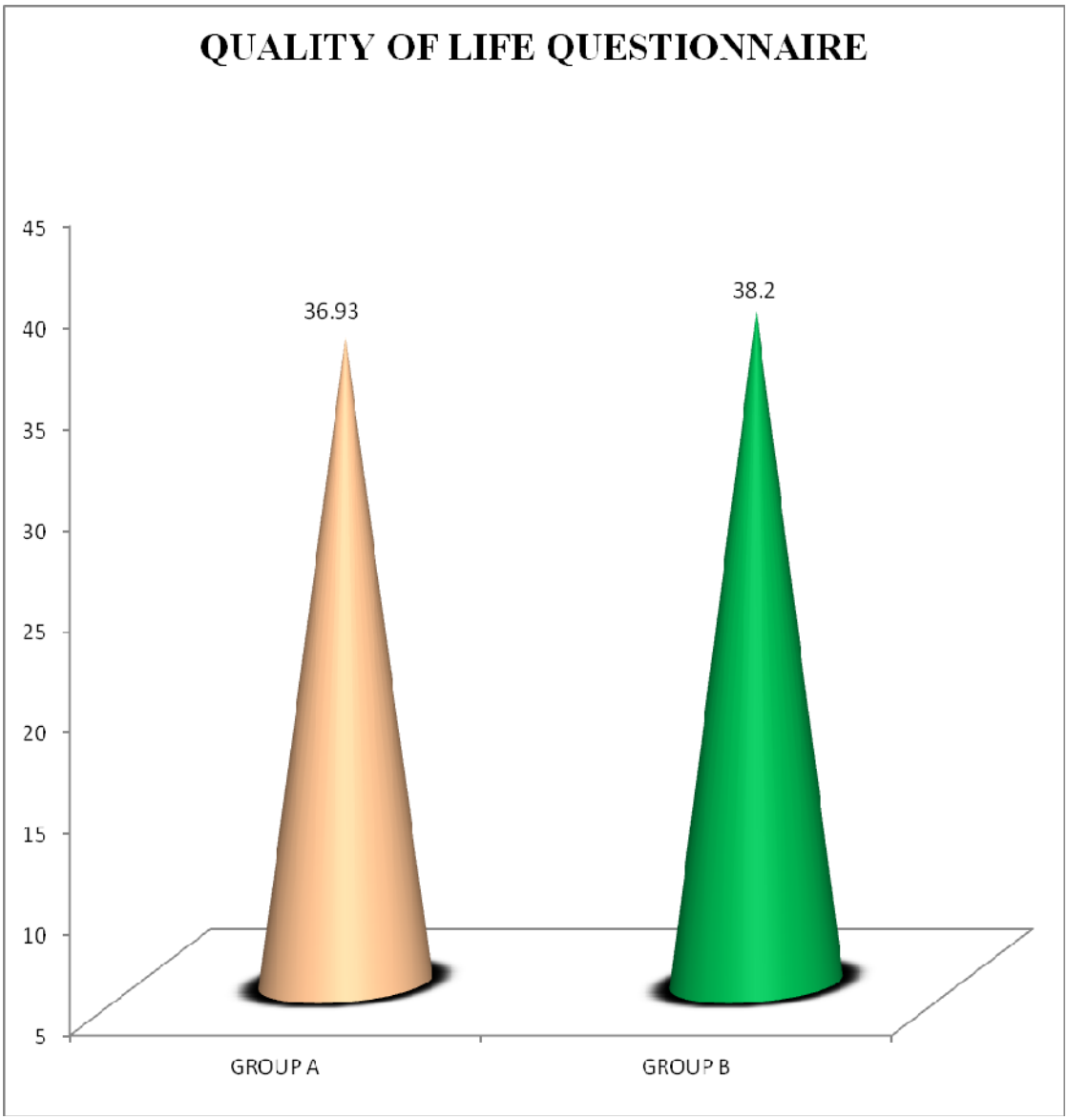
4.5.B. ANALYSIS OF RESULT

Using independent ‘t’ test

Comparing the pre test Quality of life questionnaire of Group A and Group B. Calculated ‘t’ value (1.6396) is less than table value (1.701) at 5% level of significance for ‘t’ test showing that there is no significant difference between two groups.

4.5.C. GRAPH-V

GRAPHICAL REPRESENTATION OF PRE TEST VALUES OF GROUP A AND GROUP B



Graph shows the pre test means of Quality of life questionnaire of Group A and Group B.

4.6.A. TABLE-VI

PRE TEST AND POST TEST VALUES OF GROUP A

QUALITY OF LIFE QUESTIONNAIRE

S.NO	GROUP A	MEAN	STANDARD DEVIATION	't' VALUE	PERCENTILE DECREASE
1.	PRE TEST	36.93	± 2.40	13.5477	32.3%
2.	POST TEST	25.00	± 4.26		

Table shows statistical analysis of pre and post test values of Quality of life questionnaire of Group A.

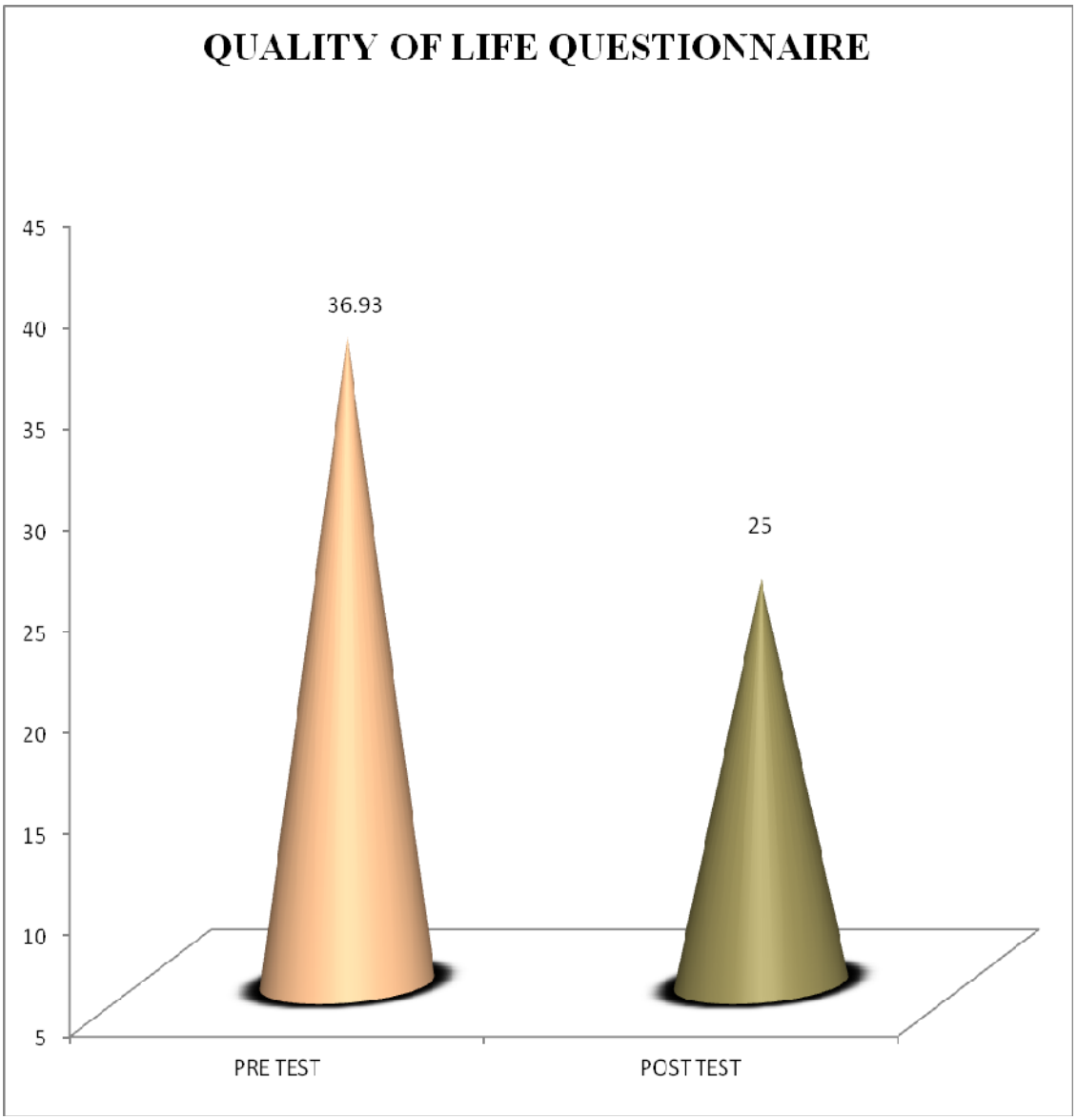
4.6.B. ANALYSIS OF RESULT

Using dependent ‘t’ test

Comparing pre and post test Quality of life questionnaire of Group A. Calculated ‘t’ value (13.5477) is greater than table value (1.761) at 5% level of significance for ‘t’ test showing that there is a significant difference between two values.

4.6.C. GRAPH-VI

GRAPHICAL REPRESENTATION OF PRE TEST AND POST TEST VALUES OF GROUP A



Graph shows the pre test and post test means of Quality of life questionnaire of Group A.

4.7.A TABLE-VII

PRE TEST AND POST TEST VALUES OF GROUP B

QUALITY OF LIFE QUESTIONNAIRE

S.NO	GROUP B	MEAN	STANDARD DEVIATION	't' VALUE	PERCENTILE DECREASE
1.	PRE TEST	38.20	± 1.78	18.2609	44.5%
2.	POST TEST	21.20	± 2.88		

Table shows statistical analysis of pre and post test values of Quality of life questionnaire of Group B.

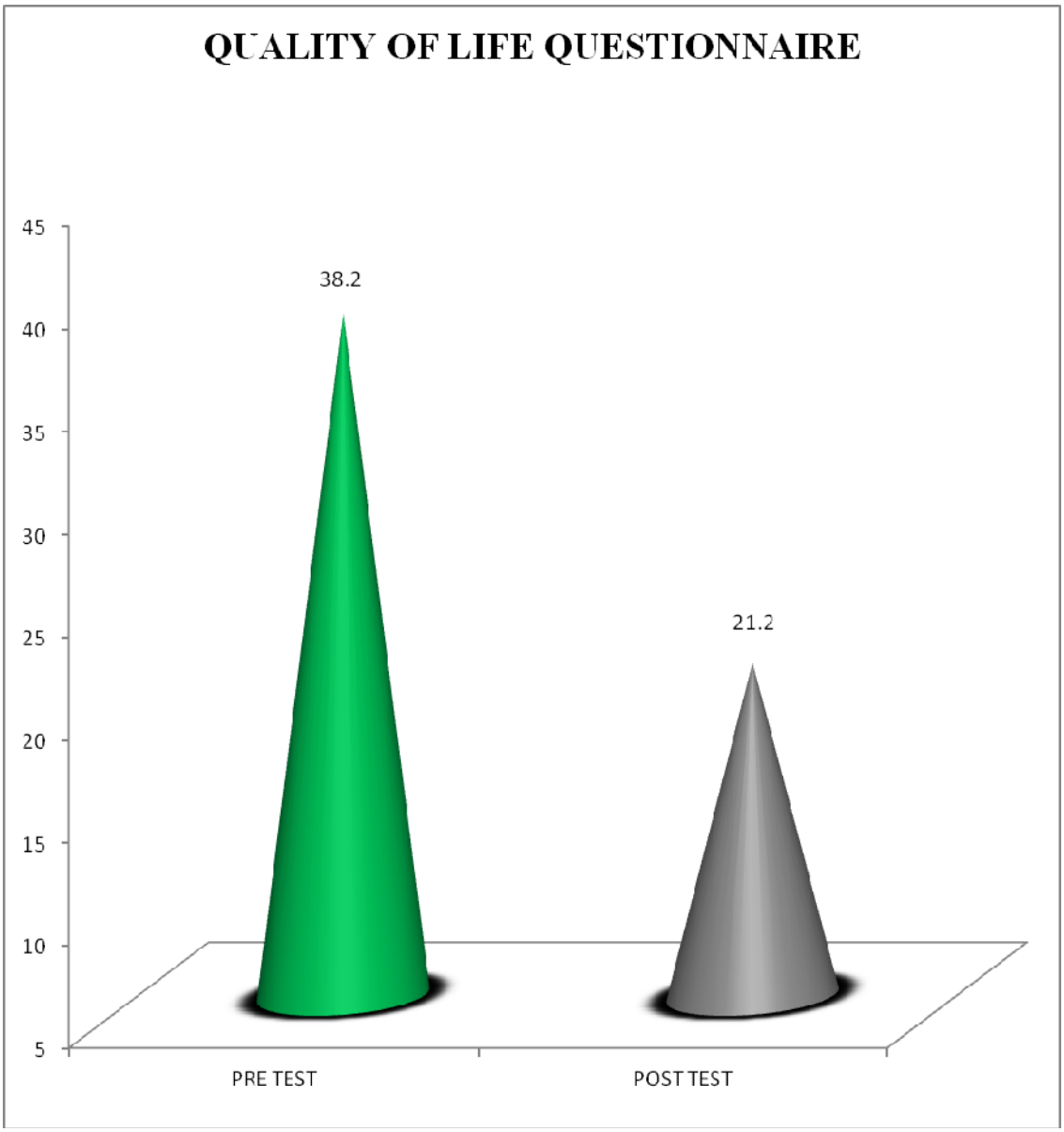
4.7.B. ANALYSIS OF RESULT

Using dependent ‘t’ test

Comparing pre and post test Quality of life questionnaire of Group B. Calculated ‘t’ value (18.2609) is greater than table value (1.761) at 5% level of significance for ‘t’ test showing that there is a significant difference between two values.

4.7.C. GRAPH-VII

GRAPHICAL REPRESENTATION OF PRE TEST AND POST TEST VALUES OF GROUP B



Graph shows the pre test and post test means of Quality of life questionnaire of Group B.

4.8.A TABLE-VIII

COMPARISON BETWEEN THE POST TEST VALUES OF GROUP A AND GROUP B

QUALITY OF LIFE QUESTIONNAIRE

S.NO	GROUPS	MEAN	STANDARD DEVIATION	't' VALUE
1.	GROUP A	25.00	± 4.26	2.8619
2.	GROUP B	21.20	± 2.88	

Table shows statistical analysis of Post test values of Quality of life questionnaire of Group A and Group B.

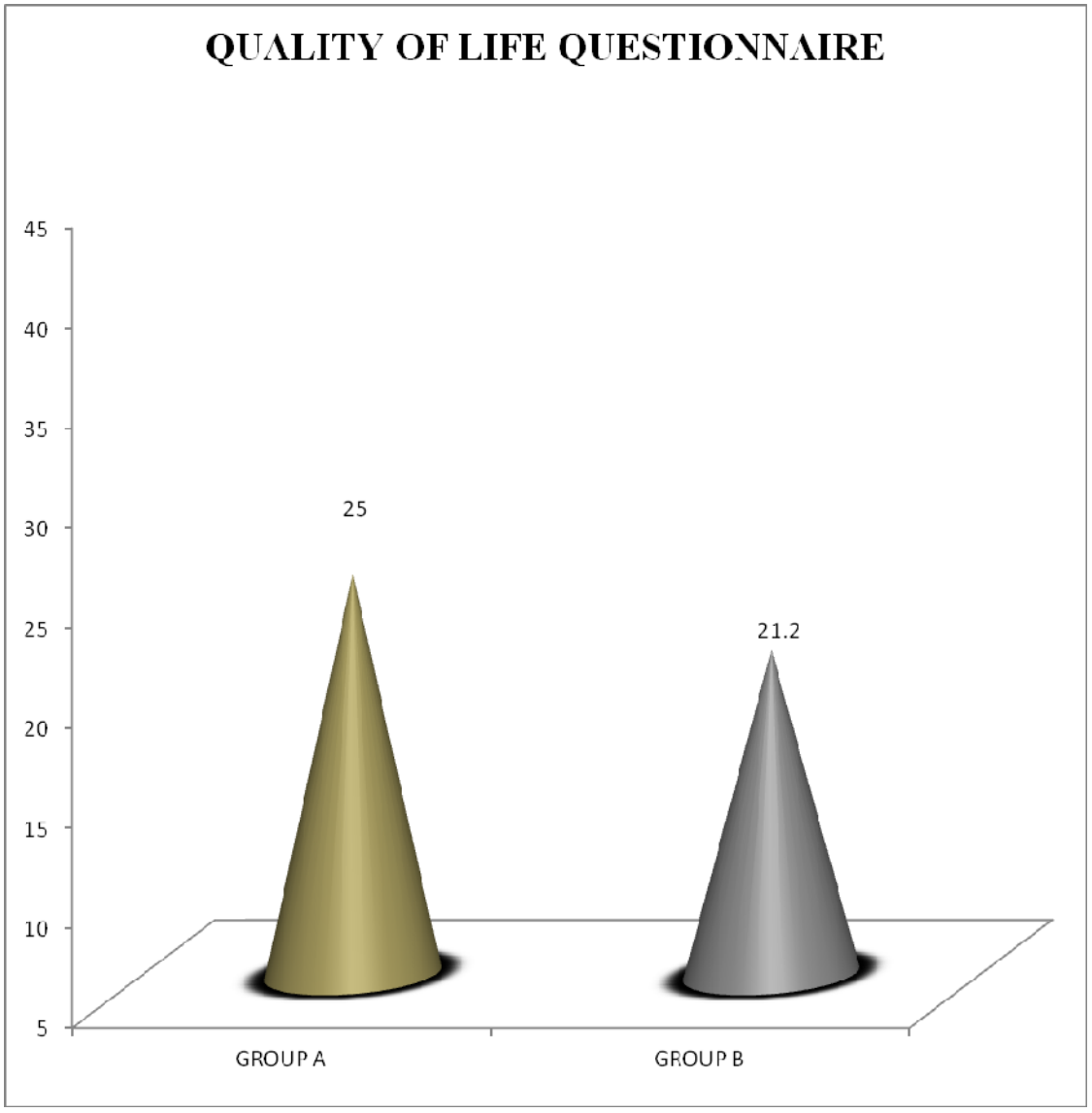
4.8.B. ANALYSIS OF RESULT

Using independent ‘t’ test

Comparing the post test values of Quality of life questionnaire of Group A and Group B. calculated ‘t’ value (2.8619) is greater than table value (1.701) at 5% level of significance for ‘t’ test showing that there is a significant difference between two groups.

4.8.C. GRAPH-VIII

GRAPHICAL REPRESENTATION OF POST TEST VALUES OF GROUP A AND GROUP B



Graph shows the post test means of Quality of life questionnaire of Group A and Group B.

DISCUSSION

This study was aimed to determine the effects of continuous moderate training and aerobic interval training modes of exercise to improve the functional capacity and quality of life in post coronary artery bypass graft subjects.

This study aimed for emphasizing that exercise intensity was an important factor in improving functional capacity and quality of life in subjects who underwent coronary artery bypass graft.

Viswanathan mohan et al., 2001, concluded that there was a higher prevalence of coronary artery disease among the urban south Indian population. The Coronary artery disease patients had a greater survival benefit by means of coronary artery bypass graft surgery (Robert H Jones et al., 1996).

Cardiac rehabilitation program was effective in reducing the cardiac mortality by 20%-26% compared to standard medical treatment (Taylor RS et al., 2004). The functional capacity has been shown to be a best predictor for increasing the survival rate in coronary artery bypass graft subjects (Froslicher V et al., 2002). The quality of life was improved in the subjects who had underwent cardiac rehabilitation as an individual programme considering all the principles of training (modes, frequency, intensity and duration). Exercise intensity was an important element in the exercise training (Mc ardle Katch & Katch et al., 2006).

In this study, a total of 30 subjects with post coronary artery bypass graft who fulfilled the inclusion criteria were selected and randomised into two groups with 15 subjects in each group. Group A underwent continuous moderate training and Group B underwent aerobic interval training.

The continuous moderate training was given for 30 minutes as continuous walking on treadmill with 70% of heart rate maximum. Yoshiharo Kashi et al., 2003, concluded that continuous moderate training improved the exercise tolerance and vasodilator capacity in post coronary artery bypass graft patients. Many studies concluded that continuous moderate intensity training improved the functional capacity in subjects who underwent coronary artery bypass graft surgery.

Aerobic interval training was given for 60 minutes as 5 minutes of exercise period & 5 minutes of rest period. In these subjects exercise training with 90% of heart rate maximum and rest period with 70% of heart rate maximum. K Meyer et al., 2009, concluded that aerobic interval training improved the physical performance in post coronary artery bypass subjects and also improved the peak heart rate.

The six minute walk test was a good predictor of the functional capacity in post cardiac surgery subjects (Claudia Fiorina et al., 2007). The functional capacity of the coronary artery bypass graft subjects was evaluated with six minute walk test. There was an improvement in the six minute walk distance in patients who undergone aerobic interval training (Ramin Shalani 2010).

The Quality of life was improved after the aerobic interval training in post coronary artery bypass graft surgery subjects (A Stahle et al., 1999). According to D.Caprio L et al., 1980, there was a greater improvement in Quality of life and physical performance in post CABG subjects after aerobic interval training.

According to Anja Bye, from the department of circulation and medical imaging, informed comments from the patients in the exercise groups indicate that aerobic interval training was found to be motivating to varied procedure to follow during training session whereas continuous moderate intensity training group found it difficult to walk.

The aerobic interval training improved the peak heart rate and physical performance in post coronary artery bypass graft subjects. Heart rate and VO_2 maximum was increased by aerobic interval training and the improvement was sustained for more than 6 months. The efficiency and health related quality of life was improved significantly after aerobic interval training. The six minute walk distance was increased significantly by aerobic interval training (Majid Sadegifar et al., 2010).

Vivianem Conraals et al., 2010, concluded that there was superior effects occurred in aerobic interval training compared with continuous moderate intensity training in coronary artery bypass graft subjects. The effect of aerobic training was sustained and there was an improvement in functional capacity of these subjects.

Trine Moholdl et al., 2009, concluded that there was a significant improvement in VO_2 max and quality of life after aerobic interval training compared to continuous moderate intensity training in post coronary artery bypass graft patients. The peak heart rate was increased in aerobic interval training group than continuous moderate training group. According to G Korvio et al., 2007, quality of life showed greater improvement in subjects who had undergone aerobic interval training mode of exercise.

Based on the above consideration exercise prescription for post coronary artery bypass graft subjects were mainly based on modes of exercise. Aerobic interval training improved the functional capacity and quality of life in post coronary artery bypass graft subjects. Thus aerobic interval training is proved to be more beneficial than continuous moderate training in subjects who underwent coronary artery bypass graft surgery.

SUMMARY AND CONCLUSION

The purpose of the study was to find the efficacy of continuous moderate training and aerobic interval training in the improvement of functional capacity and quality of life in post CABG subjects. 30 subjects with Post CABG were selected for the study and divided into two equal groups. The subjects were selected using simple random sampling method. All the subjects selected were divided into two equal groups, 15 subjects in each. Group A subjects underwent continuous moderate training where as Group B subjects underwent aerobic interval training. The study was done for a duration of 6 months, treatment was given for 12 weeks, four times weekly, a clear exercise schedule was given to every individual participant.

Outcome measures used in the study were functional capacity and quality of life. The parameters used were six minute walk distance and quality of life questionnaire.

The pre test of the outcome was measured before the initiation of the training, and the post test outcome was measured after 3 months. The student 't' test was used to find out the significant difference in the improvement of the treatment.

Based on the statistical analysis, subjects in Group B showed a marked improvement in functional capacity and quality of life when compared with subjects in Group A.

Conclusion:

1. There is a significant improvement in functional capacity in both the groups.
2. There is a significant improvement in quality of life in both the groups.
3. When compared with Group A, Group B showed a marked improvement in functional capacity.
4. When compared with Group A, Group B showed a marked improvement in quality of life.

So this study concludes that there is improvement in functional capacity and quality of life through application of continuous moderate training and aerobic interval training. Compared to Group A, Group B showed significant improvement in functional capacity and quality of life in subjects with post coronary artery bypass graft.

LIMITATION AND RECOMMENDATION

LIMITATIONS OF THE STUDY

- The sample size of this study was small.
- The information on the safety and injury risk of the training protocol in the general population was not known.
- Influence of drug, climate and psychological factors cannot be controlled.
- Only subjects with coronary artery bypass graft were taken for the study.
- Psychological status was not evaluated.

FUTURE RECOMMENDATION

- The study can be done with large samples.
- Large age group can be considered.
- The VO_2 max and heart rate recovery can also be measured.
- The work and rest ratio can be changed as 1:2, 1:4, etc.
- The aerobic interval training can be compared with other training.
- Patients who underwent treatment with percutaneous Transluminal Angioplasty, Stent placement or other interventions for coronary artery disease can be included for the future study.

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APPENDIX

APPENDIX -I

CARDIOPULMONARY ASSESSMENT

Name :

Age :

Sex :

Occupation :

Height : Date of Admission :

Weight : Date of Assessment :

Chief complaints : Date of Surgery :

HISTORY

Present medical history :

Past medical history :

Family history :

Social History :

Personal History :

Associated problem :

Vital signs:

Heart rate :

Blood Pressure :

Respiratory rate :

Temperature :

OBJECTIVE ASSESSMENT

On observation

Built :

Colour :

Chest shape :

Symmetry :

Breathing pattern :

Chest movement :

Intercostals retraction :

Periphery/extremities :

Clubbing :

Cyanosis :

Respiratory distress :

Type of respiration :

Use of accessory muscles:

Vocal fremitus :

On Palpation:

Tracheal deviation :

Chest expansion :

- ✓ Axilla level
- ✓ Nipple level
- ✓ Xiphoid level

Tenderness :

Oedema :

On Examination

On Auscultation

Heart sounds :

Lung sounds :

Abnormal breath sound :

Wheeze Rails

Rhonchi Crepitus

INVESTIGATION:

X-Ray :

E.C.G :

Echocardiogram :

ABG Analysis :

Blood test :

Exercise tolerance :

DIAGNOSIS:

APPENDIX - II

Treadmill is used to assess and to improve the functional capacity of the individual.

CONTINUOUS MODERATE TRAINING

GROUP A

Subjects are given a warm up period of 10 minutes that account up to 50% maximum of the heart rate. The intensity of the exercise is increased to the target intensity which is 70% of the maximum heart rate for a period of 30 minutes. The cool down period is of 50% of the maximum heart rate for a period of 10 minutes.

AEROBIC INTERVAL TRAINING

GROUP B

Subjects are given a warm up period of 10 minutes which is 50% of maximum heart rate. The exercise phase is performed at a ratio of 1:1 (exercise to rest) where subjects are encouraged to walk for a limit of 90% of maximum heart rate for 5 minutes and a rest period of 70% of maximum heart rate for a period of 5 minutes for a total of 60 minutes. The cool down period is of 50% of the maximum heart rate for a period of 10 minutes.

APPENDIX – III

EXERCISE STRESS TESTING

Exercise stress testing is the most important noninvasive procedure used for the diagnosis and management of patients with coronary artery disease.

Exercise stress testing involves progressive increase in the oxygen demand and evaluate the response to increase in demand.

Purposes of exercise stress test

- Evaluation of abnormalities in coronary circulation.
- Evaluation of atypical chest pain and arrhythmias.
- Determination of prognosis and severity of coronary artery disease.
- Evaluation of the effects of medical or surgical therapy or other interventions.
- Assessment of functional capacity.
- Screening to provide an exercise prescription.
- Providing motivation for a lifestyle change to reduce the risk of developing coronary artery disease.

Modes of exercise testing

Motor driven treadmill

CRITERIA FOR TERMINATION OF TEST

Absolute indication

- ST- segment elevation (1mm) in leads without Q waves (other than V1 or a VR).
- Drop in systolic blood pressure 10mm Hg (persistently below baseline), despite an increase in workload, when accompanied by any other evidence of ischemia.
- Moderate to severe angina (grade 3 to 4).
- Central nervous system symptoms (eg: ataxia, dizziness, or near syncope).
- Signs of poor perfusion (cyanosis or pallor).
- Sustained ventricular tachycardia.
- Technical difficulties monitoring the ECG or systolic blood pressure.
- Subject's request to stop.

Relative Indications

- ST or QRS changes such as excessive ST displacement (horizontal or down sloping of .2mm) or marked axis shift.
- Drop in systolic blood pressure 10mm Hg (persistently below baseline). Despite an increase in workload, in the absence of other evidence of ischemia.
- Increasing chest pain.
- Fatigue, shortness of breath, wheezing, leg cramps, or claudication.

- Arrhythmias other than sustained ventricular tachycardia, including multifocal ectopic, ventricular triplets, supra ventricular tachycardia, heart block and brady arrhythmias.
- Hypertensive response (systolic blood pressure >250 mmHg and/or diastolic blood pressure >115 mmHg).

Contraindications to exercise testing

Absolute

- Absolute MI (within 2 days).
- High risk unstable angina.
- Uncontrolled cardiac arrhythmias causing symptoms of hemodynamic compromise.
- Active endocarditis.
- Symptomatic severe aortic stenosis.
- Decompensated symptomatic heart failure.
- Acute pulmonary heart failure
- Acute noncardiac disorder that may affect exercise performance or be aggravated by exercise (eg: infection, renal failure and thyrotoxicosis).
- Acute myocarditis or pericarditis.
- Physical disability that would preclude safe and adequate test performance.

Relative

- Left main coronary stenosis or its equivalent.
- Moderate stenotic valvular disease.
- Electrolyte abnormalities.
- Tachy arrhythmias or brady arrhythmias.
- Atrial fibrillation with controlled ventricular rate.
- Hypertrophic Cardiomyopathy.
- Mental impairment leading to inability to cooperate.
- High degree AV block.

APPENDIX IV

Classification of intensity of exercise

(Adapted from ACSM guide book for exercise prescription and training, 2nd edition)

INTENSITY	% HRR TO % VO2 max	% HR max	RPE
Very light	30	35	10
Light	30-49	35-59	10-11
Moderate	50-74	60-79	12-13
Hard	75-84	80-89	14-16
Very Hard	85	90	17-19
Maximal	100	100	20

APPENDIX V

TREADMILL TEST WORKSHEET

Name _____ Date_____ Age_____

Sex _____ Weight _____ Height _____ Diagnosis _____

Reason for test _____ Protocol _____

12 Lead ECG Interpretation _____

Time _____ Medications _____

Time last dose _____ Time last meal _____

Physician _____ Activity status _____

_____

TEST RESULTS

Minutes completed _____ Limiting factors_____

Resting heart rate _____ Maximal heart rate _____

Resting BP _____ Maximal BP _____

BP Response _____

Chest pain _____

Summary ST changes _____

Heart sounds _____ Dysarrhythmias _____

Physical work capacity _____

Remarks / Recommendations _____

Interpreted by _____

APPENDIX VI

SIX MINUTES WALK PROTOCOL - Process

1. Gather equipment; sphygmomanometer, stethescope, pulse oximeter, stop watch, pen and relevant paperwork.
2. Explain to subjects that they must walk for a period of 6 minutes over a set distance.
3. They must walk at a moderate pace that is comfortable to them.
4. Pre test: BP, HR, O2 saturation and symptoms if any.
5. Once the subjects start to walk encourage them every two minutes with statements such as "doing well' and at the same time check the subjects that they have any symptoms.
6. Inform subjects every two minutes of the time lapse.
7. Post test: BP, HR, O2 saturation and symptoms if any, and Borg Scale-perceived rated exertion scale.

Rationale:

- The six minute walk test will enable the staff to prescribe appropriate exercise for the subjects.
- It is also used as a prognostic tool. For subjects who have poor performance (less than 300m) they have a greater chance of hospitalization and adverse events. For those who have a drop in systolic blood pressure during post test, it is a predictor of greater cardiovascular damage.
- This test is also used as an objective evaluation tool for the rehabilitation program.

APPENDIX-VII

NATIONAL AUDIT CARDIAC REHABILITATION

QUALITY OF LIFE QUESTIONNAIRE- www.cardiacrehabilitation.org.uk

1. **PHYSICAL FITNESS** During the past week what was the hardest physical activity you could do far at least 2 minutes?

   A. Very heavy 1

   B. Heavy 2

   C. Moderate 3

   D. Light 4

   E. Very light 5

2. **FEELINGS** During the past week how much have you been bothered by emotional problems such as feeling anxious, depressed, irritable or downhearted and blue?

   A. Not at all 1

   B. Slightly 2

   C. Moderately 3

   D. Quite a bit 4

   E. Extremely 5

3. **DAILY ACTIVITIES** During the past week how much difficulty have you had doing your usual activities or task, both inside and outside the house because of your physical and emotional health?

   A. No difficulty at all 1

   B. A little bit of difficulty 2

   C. Some difficulty 3

   D. Much difficulty 4

   E. Could not do 5

4. **SOCIAL ACTIVITIES** During the past week, has your physical and emotional health, limited your social activities with family, friends, neighbours or groups?

   A. Not at all 1

   B. Slightly 2

   C. Moderately 3

   D. Quite a bit 4

   E. Extremely 5

5. **PAIN** During the past week how much bodily pain have you generally had?

    A. No pain 1

    B. Very mild pain 2

    C. Mild pain 3

    D. Moderate pain 4

    E. Severe pain 5

6. **CHANGE IN HEALTH** How would you rate your overall health now compared to a week ago?

    A. Much better 1

    B. A little better 2

    C. About the same 3

    D. A little worse 4

    E. Much worse 5

7. **OVERALL HEALTH** During the past week how would you rate your health in general?

    A. Excellent 1

    B. Very good 2

    C. Good 3

    D. Fair 4

    E. Poor 5

8. **SOCIAL SUPPORT** During the past week, was someone available to help you if you needed help?

   A. As much as I wanted 1

   B. Quite a bit 2

   C. Some 3

   D. A little 4

   E. Not at all 5

9. **QUALITY OF LIFE** How have things been going for you during the past week?

   A. Very well 1

   B. Pretty good 2

   C. Good 3

   D. Pretty bad 4

   E. Very bad 5

APPENDIX VII

CONSENT FORM

This is to certify that I _____ freely and voluntarily agree to participate in the study **"A COMPARATIVE STUDY TO ANALYZE THE EFFICACY OF TWO DISTINCTLY DIFFERENT MODES OF EXERCISE IN IMPROVING FUNCTIONAL CAPACITY AND QUALITY OF LIFE IN SUBJECTS WITH CORONARY ARTERY BYPASS GRAFT".**

I have been explained about the procedures and the risks that would occur during the study.

Participant:

Witness:

Date:

I have explained and defined the procedure to which the subject has consented to participate.

Researcher:

Date: